

storage devices to be assigned to the selected host based on that file system type. For example, in one related aspect, the invention provides such a SAN in which the number of assigned storage devices (n) for a RAID file system having no stripes and a number of mirror redundancies (m) is determined in accord with the relation $n = m + 1$.

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A related aspect of the invention provides a SAN as described above in which the number (n) of same-sized storage devices assigned to a host digital data processor having (s) stripes and no mirror redundancies is determined in accord with the relation $n = s$.

10 A still further aspects of the invention provides a SAN as described above in which the number (n) of same-sized storage devices assigned to a host digital data processor having (s) stripes, each with (m) mirror redundancies is determined in accord with the relation $n = s*(m + 1)$.

15 A still further aspects of the invention provides a SAN as described above in which the number (n) of same-sized storage devices assigned to a host digital data processor having (m) mirror redundancies spread over (s) stripes in accord with the relation $n = (m+1)*s$.

Rendering a SAN Topology

In further aspects, the invention provides improvements on a storage area network ("SAN") of the type that includes one or more digital data processors (e.g., the aforementioned hosts) that are coupled for communication with one or more storage devices (e.g., LUNs) over an interconnect. The improvement provides a mechanism for hierarchically displaying, e.g., on the administrator console or other output device, portions of the SAN topology. Particularly, the SAN is divided into segments to facilitate display and, thereby, locating failing devices in the SAN. A graphical user interface displays icons for each SAN and divides the topology into submaps, i.e., a screen that contains icons – where double clicking on an icon will show another submap if the icon is not a leaf node. The SAN is divided into several types of segments: a switch segment contains an icon representing an individual switch and the devices directly connected to the switch; a switch port connected to multiple devices is represented by a loop segment. The segment contains an icon for the switch and the devices.

According to further aspects of the invention, the improvement provides a process that generates for application to the output device a plurality of graphical objects that represent "segments" of the SAN and/or components of the SAN, along with the interconnections between them. Thus, for example, a first graphical object displayed on the output device can represent a first segment of the SAN. A second graphical object can represent either a second segment of the SAN or a component (e.g., host or storage device) of the SAN. And, a third graphical object can represent the portion of the interconnect that couples the segments/component represented by the first and second graphical objects. The process selectively responds to operator/ administrator selection

of any of the graphical objects that represent a segment by regenerating the display to depict the interconnected segments and/or components that make up that segment.

A component, in this context, refers for example to a storage device or a host digital data processor, while a segment refers to portion of the SAN containing multiple such interconnected components, whether represented as (i) individual components and/or (ii) one or more further segments.

Related aspects of the invention provide a SAN as described above in which the process responds to operator selection of a graphical object representing a segment or component by displaying the attributes thereof. For example, in the case of selection of an object representing a storage device, the process can display the type and capacity of the device, its LUN identifier, and so forth. In the case of selection of an object representing a segment, the process can display its location, an enumeration of its components, and so forth.

Further aspects of the invention provide a SAN as described above in which the process displays the aforementioned graphical objects in a main presentation panel (or window) and displays further graphical objects -- referred to here as "navigational" objects -- in one or more other presentation panels. These navigation objects, too, represent components or segments of the SAN and, indeed, can correspond to the graphical objects displayed in the main panel. Alternatively, or in addition, the navigational objects can correspond to the SAN root or other segments and or components that are not direct descendants of those represented by the graphical objects in the main panel.